REMARKS

Claims 1-31 are all the claims pending in the application.

Preliminary Matters

Applicants thank the Examiner for considering the references cited with the Information Disclosure Statement filed June 3, 2002, indicating that the Formal Drawings filed February 14, 2006, are accepted, and acknowledging the claim for foreign priority.

Claim Rejections - Obvious Type Double Patenting

The Examiner has rejected claims 1-31 as being unpatentable over claims 1-31 of U.S. Pat. No. 6,717,106 in view of Hagenau (US 6,051,179) under the judicially created doctrine of obviousness-type double patenting.

Applicants submit herewith a terminal disclaimer to traverse this rejection.

Claim Rejections - 35 U.S.C. § 102(e) - Claims 1, 3-7, 10-13 and 23

The Examiner rejected claims 1, 3-7, 10-13 and 25 as being anticipated by Smith (US 6,500,378).

Regarding claim 1, Applicants submit that Smith fails to disclose, at least, using a light beam emitted from a light source and modulated for each pixel in accordance with image data and pulse driven in picosecond pulses. This much is conceded by the Examiner on page 7 with regard to the rejection of claim 2 under Smith in view of DeVoe et al. (U.S. 6,855,478).

However, assuming that the Examiner would apply DeVoe in combination with Smith, Applicants submit that one of skill would not be motivated to combine Smith with DeVoe as

alleged by the Examiner. While DeVoe may teach that pulse duration and intensity may be varied, DeVoe teaches that the femtosecond regime is most preferred and with picosecond pulses, as warned by DeVoe, the operational window is not as large. (col. 6, lines 35-36) Moreover, the picosecond pulses described therein are taught merely in conjunction with near infrared pulsed lasers having a minimum wavelength of 750 nm.. (col. 6, lines 30-40) Absent within DeVoe is any teaching or suggestion that the picosecond pulses associated with smaller operational windows will provide adequate results in a different wavelength spectrum.

Specifically, Smith discloses a device using an ultraviolet lamp source. (col. 6, lines, 47-53; col. 8, lines 35-65). Ultraviolet light has a maximum wavelength of 380 nm. Thus, in the absence of any teaching within DeVoe that picosecond pulses would in any way be applicable to an ultraviolet wave lamp source, one of skill would not be motivated to arrive at the combination attempted by the Examiner.

Moreover, Smith discloses a method of optical modeling by surface exposing. The photo-curable resin, in general, shows an increase of temperature when it is exposed to light and cured. Then, the photo curable resin shows distortion when its temperature falls due to thermal contraction. In particular, when a surface region is batch exposed as in Smith, the precision of optical modeling is significantly lowered. Thus, in the present invention, the light energy provided on the surface to be exposed is reduced to a minimum by using a picosecond pulse laser.

Thus, Applicants submit that claim 1 is allowable for at least this reason. Additionally, because claims 5, 12 and 25 recited features similar to those argued above with respect to claim 1, Applicants submit that these claims are allowable for the same reasons.

Additionally, Applicants submit that claims 3, 4, 6, 7, and 13 are allowable, at least because of their dependency.

Regarding claims 10 and 11, Applicants submit that Smith fails to disclose, at least, a plurality of exposure portions, and the exposure portions are each independently movable relative to the surface of the photo-curable resin. Smith appears to disclose multiple SLMs 4. (see Figure 3). However, Smith also discloses that these multiple SLMs 4 are linked in order to process larger cross sections or to provide improved tolerances. (col. 9, lines 41-49). While the computer control system 2 directs each SLM 4 to pivot its mirrors appropriately, there is no indication within Smith that each SLM 4 is independently movable relative to the surface of the photo-curable resin. Smith teaches that the SLMs are linked and that the control system 2 directs each SLM 4 to pivot its mirrors appropriately, but Smith is otherwise silent on any independent movement relative to the surface of the photo-curable resin. For example, each SLM may each dependently move in a predetermined distance in the X-direction in tandem. This would fulfill the objective of larger area coverage, but still not require independent movement as claimed.

Thus, because Smith fails to disclose this feature of claims 10 and 11, Applicants submit that claims 10 and 11 are allowable.

Claim Rejections - 35 U.S.C. § 103(a) - Claims 14 and 27

The Examiner rejected claims 14 and 27 under Smith in view of an obvious modification. The Examiner alleges that it would have been obvious to one skilled in the art at the time of the invention to enclose the light source, optical system, and deflecting element in a package since Smith teaches that they are all in close proximity to each other, and since it is noted that any optical system is susceptible to dust an dirt affecting its operability and a package surrounding optical elements would keep the system running optimally and within specifications.

Applicants submit that because the alleged obvious modification provided by the Examiner fails to compensate for the deficiency of Smith as discussed above with regard to claims 12 and 25 that claims 14 and 27 are allowable, at least because of their dependency.

Claim Rejections - 35 U.S.C. § 103(a) - Claims 2 and 26

The Examiner rejected claim 2 and 26 as being unpatentable over Smith in further view of DeVoe et al. (US 6,855,478). Applicants traverse this rejection as follows.

The Examiner concedes that Smith does not explicitly teach that the light source is pulse driven in picosecond pulses. To compensate for this deficiency, the Examiner applies DeVoe alleging that DeVoe teaches the fabrication of three dimensional objects utilizing photo-hardenable compositions (col. 4, lines 5-16), whereby a light source may produce pulses in the picosecond range and below (col. 6, lines 31-44). Furthermore, the Examiner alleges that DeVoe teaches that pulse durations can be adjusted fast or slow depending on desired curing results (citing Devoe, col. 4, lines 23-28), and pulsed lasers with fast oscillators are considered useful exposure systems.

In contrast, Applicants submit that one of skill would not be motivated to combine Smith with DeVoe as alleged by the Examiner. While DeVoe may teach that pulse duration and intensity may be varied, DeVoe teaches that the femtosecond regime is most preferred and with picosecond pulses, as warned by DeVoe, the operational window is not as large. (col. 6, lines 35-36) Moreover, the picosecond pulses described therein are taught merely in conjunction with near infrared pulsed lasers having a minimum wavelength of 750 nm.. (col. 6, lines 30-40). Absent within DeVoe is any teaching or suggestion that the picosecond pulses associated with smaller operational windows will provide adequate results in a different wavelength spectrum.

Specifically, Smith discloses a device using an ultraviolet lamp source. (col. 6, lines, 47-53; col. 8, lines 35-65). Ultraviolet light has a maximum wavelength of 380 nm. Thus, in the absence of any teaching within DeVoe that picosecond pulses would in any way be applicable to an ultraviolet wave lamp source, one of skill would not be motivated to arrive at the combination attempted by the Examiner.

Thus, Applicants submit that claims 2 and 26 are allowable over the applied combination.

Claim Rejections - 35 U.S.C. § 103(a) - Claims 8-9, 22-24 and 31

The Examiner rejected claims 8-9, 22-24 and 31 as being unpatentable over Smith in further view of Jain et al. (US 6,312,134; "Jain"). Applicants traverse this rejection as follows.

Claims 8 and 9

The Examiner alleges that Smith discloses many of the features of claim 8, but concedes that it fails to explicitly teach a scanning mirror for scanning in a second direction intersecting

the first direction, nor that the moving portion moves the exposure portion in the first scanning direction and the second scanning direction intersecting the first scanning direction.

To compensate for this deficiency the Examiner applies Jain alleging that it teaches a rapid prototyping system which utilizes SLM's and DMD's which scans in a first direction and then again in a second direction, orthogonal to the second direction. Further, the Examiner alleges that it would have been obvious to one skilled in the art at the time of the invention to scan in a second direction intersecting the first scanning direction since this would allow seamless exposure from one scan to the next (citing col. 11, lines 54-58), and, further, since this would enable high processing throughputs to be achieved while maintaining high resolution over arbitrarily large image fields (citing col. 6, lines 8-10).

Applicants submit, in contrast to the Examiner's contentions, that the device of Jain only scans in a single direction and, therefore, fails to teach or suggest "a scanning mirror for scanning in a second direction," as recited in claim 8.

For example, Jain disclose a stage 6 that moves in a constant velocity in the y direction while the substrate 5 is illuminated by a beam pattern 31. (col. 11, lines 20-24). After this scan is complete, the stage 6 moves in a direction orthogonal to the y-direction, i.e. x-direction. (col. 11, lines 54-61). Furthermore, Jain teaches that control of the displacement of the stage 6 in the x-direction is important to maintain seamless exposure from one scan to the next. Furthermore, Jain teaches if the intensity profile across each scan (x-direction) were constant, then stage 6 would have to move in the x-direction by an amount exactly equal to the scan width. (*Id.*)

It is apparent from this teaching that Jain discloses a system where there are only consecutive scans in the x-direction. The movement in the y-direction is not a scan at all, but merely a means of adjusting the stage 6 for the next adjacent scan. No portion of Jain discloses that there is an illuminated beam pattern emitted during the y-direction adjustment. Thus, there is no y-direction scan. Jain covers the material to be scanned by scanning in the y-direction in a predetermined width after which the stage 6 is moved in the x-direction to permit another y-direction scan over an unexposed area.

Thus, Applicants submit that claim 8 is allowable because neither Smith nor Jain, alone or in combination, teach or suggest "a scanning mirror for scanning in a second direction." Further, Applicants submit that dependent claim 9 is allowable, at least because of its dependency.

Claims 22-24

Regarding claims 22-24, the Examiner alleges that Smith teaches many of the features recited, but concedes that Smith fails to explicitly teach that the light source comprises a plurality of laser light sources, and a multiplexing optical system for multiplexing the laser beams emitted from the plurality of laser light sources. To compensate for this deficiency, the Examiner applies Jain alleging that it teaches a rapid prototyping system which utilizes SLM's and DMD's whereby multiple lasers may be utilized. (citing col. 7, lines 46-54 and col. 8 lines 11-17). Additionally, the Examiner alleges that Jain teaches that the optical system is used to steer the lasers.

Applicants submit that because Jain fails to compensate for the above noted deficiencies of Smith as applied to claims 1, 5 and 11 that claims 22-24 are allowable, at least because of their dependency.

Claim Rejections - 35 U.S.C. § 103(a) - Claims 16-21 and 29-30

The Examiner rejected claim 16-21 and 29-30 under § 103(a) as being unpatentable over Smith in further view of Tanaka et al. (US 6,274,891; "Tanaka"). Applicants traverse this rejection as follows.

Regarding claims 16-21 and 29-30, the Examiner concedes that Smith fails to explicitly teach that the light source comprises a gallium nitride (GaN) semiconductor laser, or that a gallium nitride semiconductor laser is coupled to a fiber. To compensate for this deficiency, the Examiner applies Tanaka, alleging that it teaches the production and use of a GaN based semiconductor laser (citing col. 5, lines 19-27), and also teaches that the lasers may be coupled to fibers. (col. 25, lines 63-67)

As a motivation to combine, the Examiner contends that it would have been obvious to one skilled in the art at the time of the invention was made to utilize a GaN semiconductor laser coupled to a fiber in the invention taught by Smith since a GaN laser allows obtaining a gain guiding structure of high light emitting efficiency (citing Tanaka, col. 5, lines 22-24), allows a laser to emit a shorter wavelength than traditional lasers (citing Tanaka, col. 1, lines 24-28), and since focusing a laser in to a fiber allows a small-sized semiconductor laser to be obtained and used easily. (Tanaka, col. 11, lines 64 through col. 12, line 2). However, Applicants submit that this motivation is an ad hoc attempt by the Examiner to support the attempted combination.

Furthermore, the above described benefits of the GaN laser have absolutely no correlation with the device as disclosed by Smith. Thus, one of ordinary skill in the art would not be motivated to make the combination forwarded by the Examiner.

Additionally, while Tanaka may teach or suggest the above, there is simply no relation between these factors and a motivation to combine the device of Tanaka with the device of Smith. First, Tanaka is silent on using the GaN laser within an optical modeling device in which a light beam is exposed onto a photo-curable resin to form a three-dimensional model. Second, Smith teaches of using a single energy source 8 to illuminate the complete surface of spatial light modulator 4. No portion of Smith teaches that a shorter wavelength is beneficial, that a small sized semiconductor laser is desirable or that a gain guiding structure of high light emitting efficiency is desirable. In fact, Smith teaches that the preferred embodiment utilizes a UVA or UVB lamp source. Finally, there is no disclosure within Tanaka that the GaN laser emits any UVA or UVB radiation.

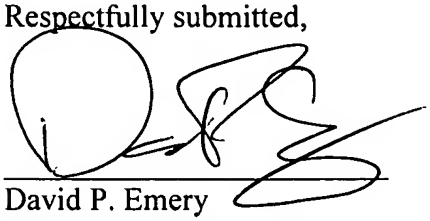
Thus, Applicants submit that claims 16-21 and 29-30 are allowable for at least this reason.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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